



Constructing activity awareness in CSCW

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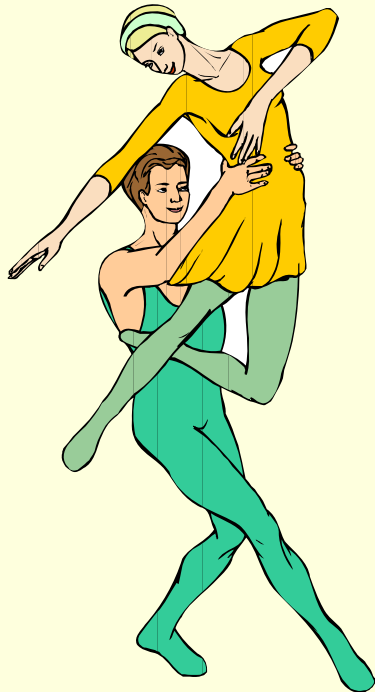


Collaboration is an intricate dance

- Establish & maintain common understandings
- Negotiate & modify goals and plans
- Assign roles, decompose/divide/coordinate work activity
- Manage artifacts & other external resources
- Integrate perspectives, suggestions, & partial work products
- Improvise & coordinate as necessary
- Interpret & evaluate outcomes



Awareness in Collaboration



- What is the other person doing and thinking?
- What is he/she paying attention to now?
- What does he/she expect me to do?
- What will he/she do next?
- Can I trust this person?

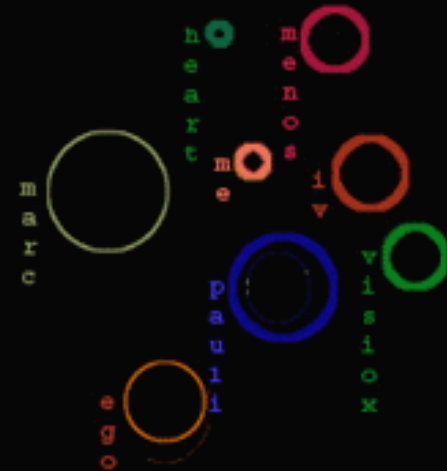


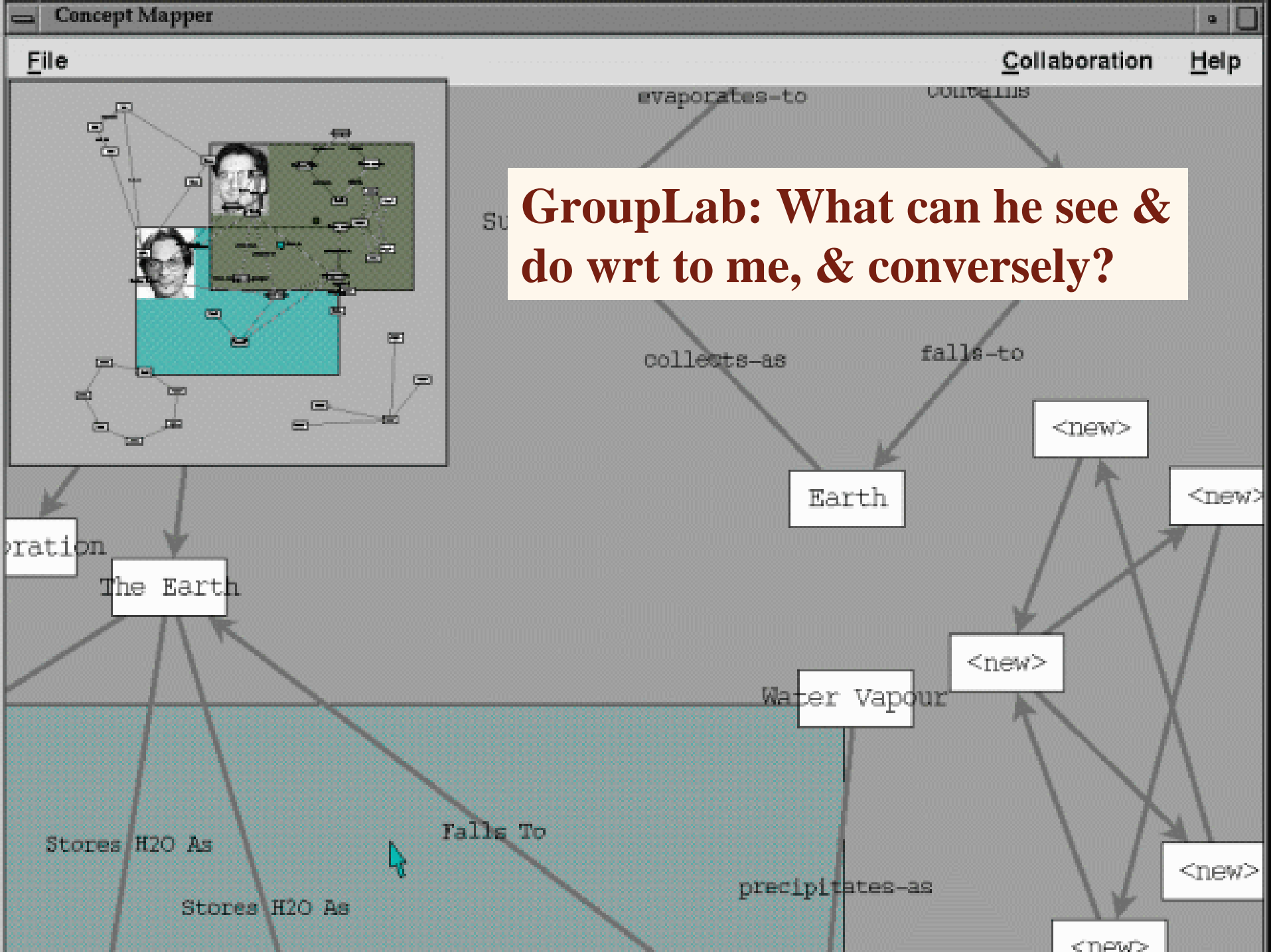
Awareness in Computer-Supported collaboration

- Is anyone there? Who?
- Am I interrupting?
- What is his/her situation (materials, tools, knowledge)?
- When will he/she finish/reply/confirm?
- Is he/she monitoring me?



Abstract graphic featuring several large, overlapping circles in yellow, green, and blue. Interspersed among the circles are lowercase letters: 'a', 'j', 'i', 'l', 'l', 'y' in yellow; 'm', 'i', 'r', 'a' in green; 'm', 'a', 'u', 'r', 'o' in yellow; and 'm' in blue. A white rectangular box in the bottom right corner contains the word 'Cha' in a large, dark red serif font.





**Clearboard: Where
is he looking now?**





In this talk ...

- *Beyond* awareness of presence, current action status, locus of visual attention
 - Presence awareness, social awareness, action awareness, workspace awareness, situation awareness
- The high, ragged regions of awareness
 - Longer term interactions in more complex and significant task contexts
 - Shared *activity* vs. shared *information*
- Implications for groupware design & evaluation



Shared Activity (Vygotsky)

- Dynamically co-constructed
 - Shared goals & plans continually revised in action
- Articulated at multiple levels
 - Collective/individual, roles, POVs, divisions of labor
 - Continually renegotiated & evolving
- Includes tools, practices, norms & other resources
- Always involves learning and innovation



Activity Awareness

- We stay on the same page
 - Testing, updating, resynchronizing
- We do this work together
 - Collective self-regulation, sharing praxis
- We are competent, trustworthy, adaptive
 - Taking initiative, relying on one another
- We take the risk to do better
 - Social modeling, emergent roles, informal learning, creativity, development



Common Ground

*Common
ground*

Protocol for continual testing and signaling
of shared knowledge and beliefs



Common Ground

- We test shared understandings to recognize and synchronize with potential collaborators
- Through testing and exploiting common ground, common ground is enhanced
- E.g., “Could we reach them via the Scotia Barrens?”

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are needed to see this picture.

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Common Ground





Communities of Practice

<i>Community of practice</i>	(Tacitly) leverage and regulate shared praxis through enactment and improvisation
<i>Common ground</i>	Protocol for continual testing and signaling of shared knowledge and beliefs

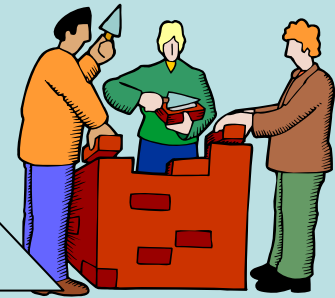


Communities of Practice

- E.g., “We need that road” \Rightarrow “Where are the power lines, gas lines, ...” (to the public works specialist)

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**Communities
of Practice**



Common Ground





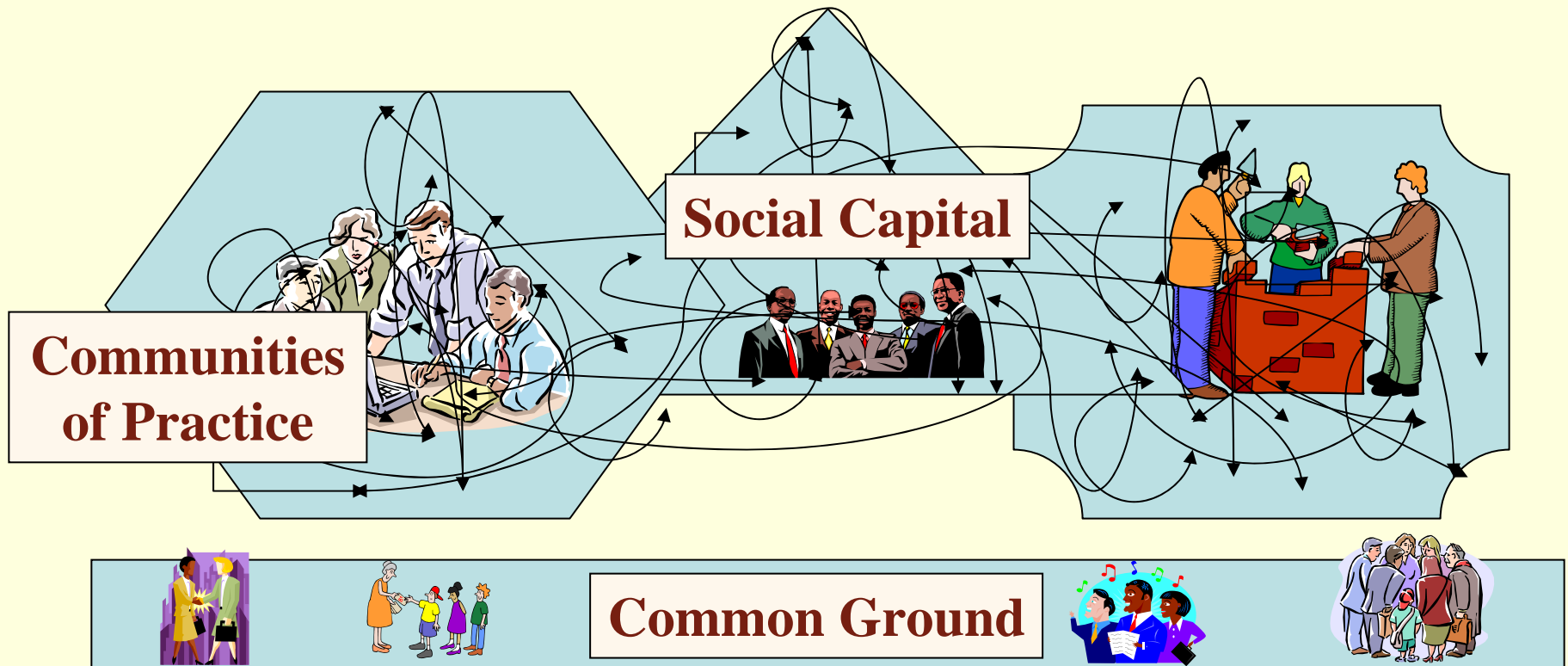
Social Capital

<i>Social capital</i>	Nurture & exploit mutual interdependencies; access broader resource networks
<i>Community of practice</i>	(Tacitly) leverage and regulate shared praxis through enactment and improvisation
<i>Common ground</i>	Protocol for continual testing and signaling of shared knowledge and beliefs



Social Capital

- E.g., “It might be more efficient to just bring those people out on your bulldozer.”





Human Development

*Human
development*

Reconcile different levels of performance and approaches to problems by synthesizing zones of proximal development

*Social
capital*

Nurture & exploit mutual interdependencies; access broader resource networks

*Community
of practice*

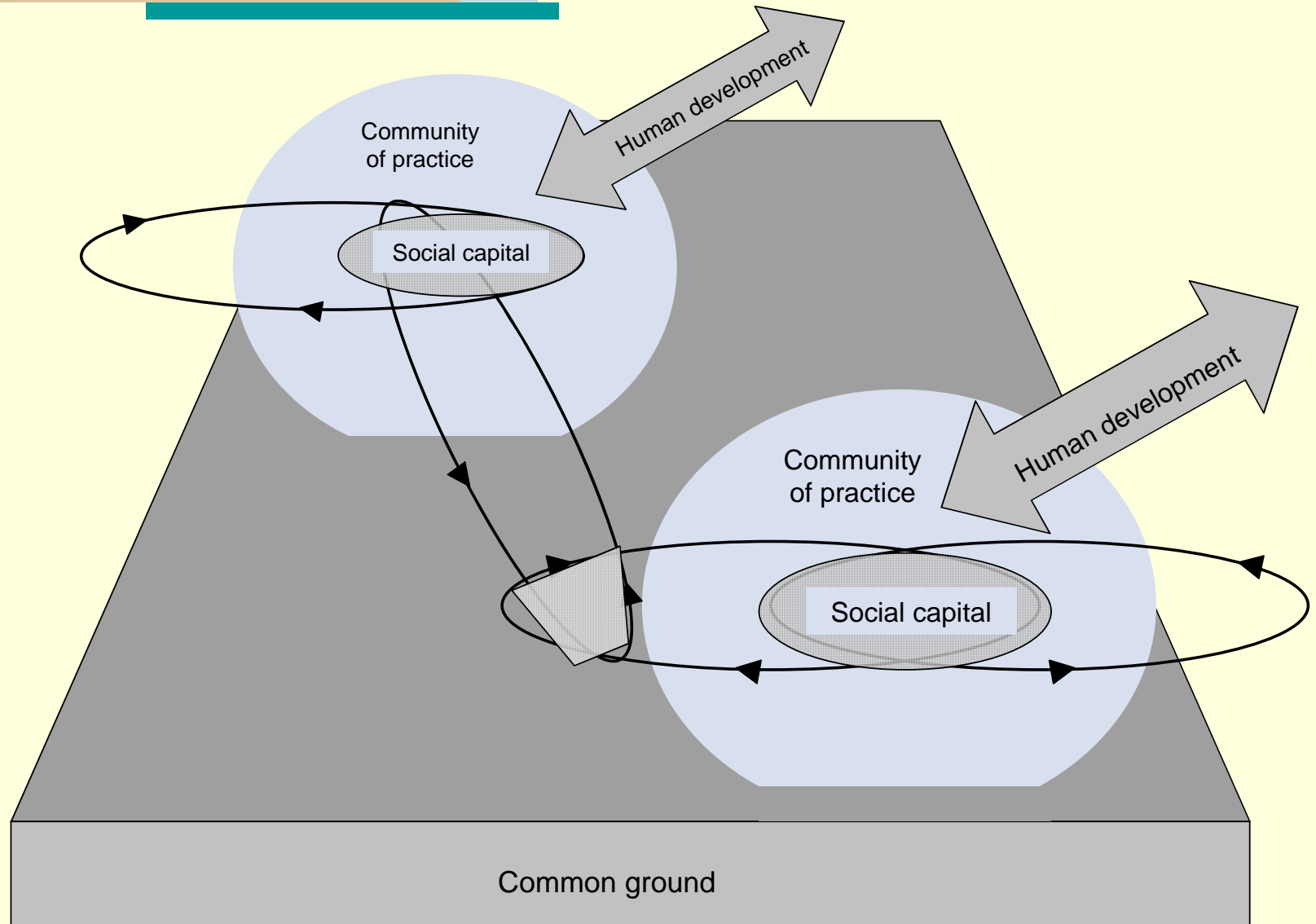
(Tacitly) leverage and regulate shared praxis through enactment and improvisation

*Common
ground*

Protocol for continual testing and signaling of shared knowledge and beliefs



Building shared activity





Implications for groupware

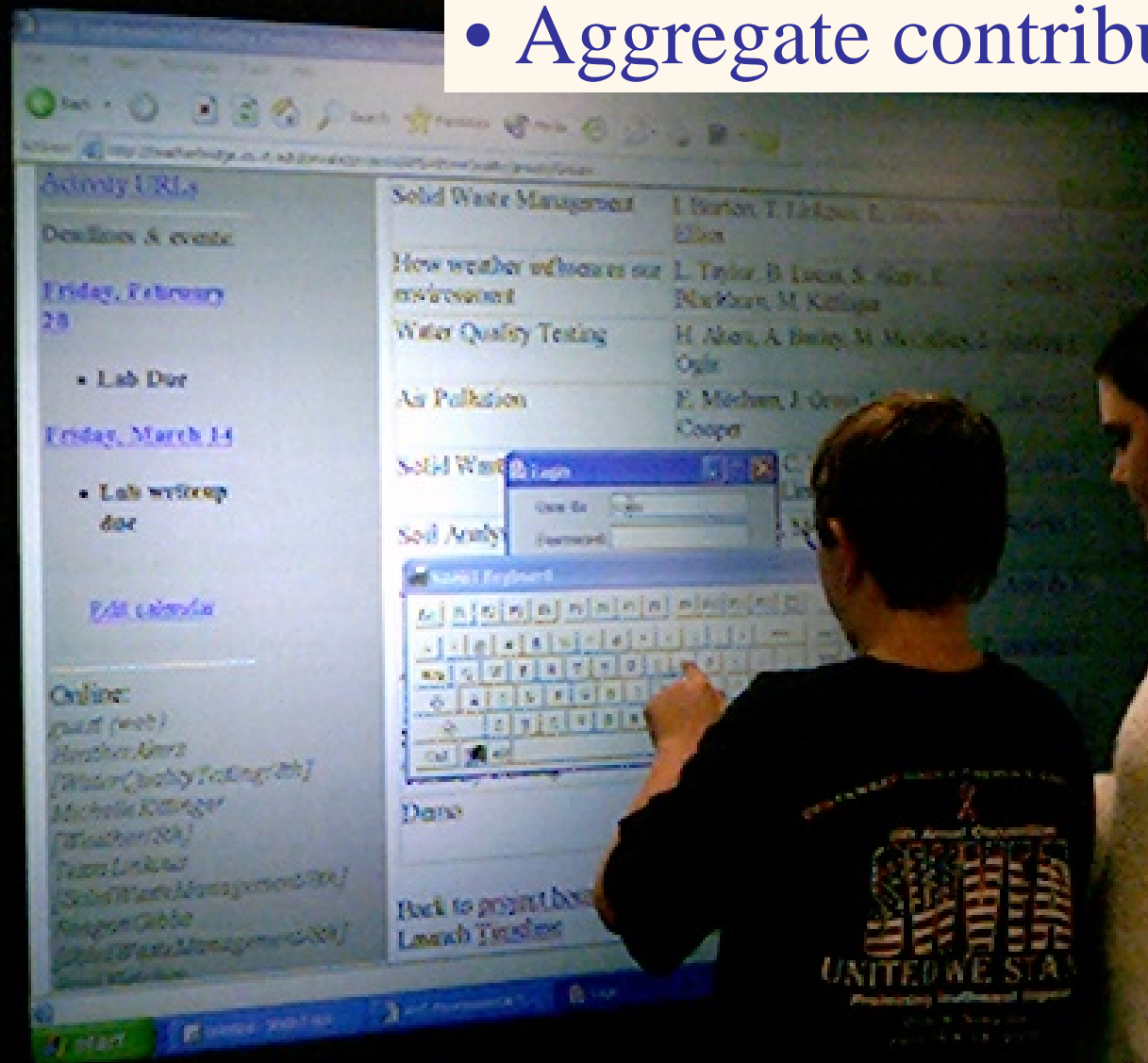
- Technology design ideas
 - “activity” as a primitive system concept (e.g., versus “thread”)
 - Visualizations of activities, workspaces for activities
- Empirical concepts and studies
 - Experimental models, tasks, measures
 - Field studies, data coding, representations



Implications for technology

<i>Human development</i>	Contrast individual capabilities, roles & achievements through time
<i>Social capital</i>	Aggregate and individuate contributions toward collective achievement
<i>Communities of practice</i>	Synthesize team members' behavior or decisions into best practices or patterns
<i>Common ground</i>	Public availability of shared information

- Public views of data
- Aggregate contributions





• Awareness of presence, roles, actions, results

Activity 1

File Edit Window Workspace Navigation

History: Oct 25, Nov 1, Nov 8, Nov 15, Nov 22, Nov 29, Dec 6, Dec 13, Dec 20, Dec 27, Jan 3, Jan 10, Jan 17, Jan 24, Jan 31, Feb 7, Feb 14, Feb 21, Feb 28

Deadline (indicated by a red arrow pointing to a vertical line on the timeline)

Project activity timeline
(Document versions, communications, events)

Scientific Principals, Future, Safety and Reliability, Introduction, Bibliography, American Maglev Systems cost less (extra bubble), Reasons Why the American, Testing The Maglev

Concept map
(project roles, decomposition)

Maglev (central node) connected to: Safety and Reliability, How it Works, History, Testing The Maglev, Reasons Why the American Maglev is a Good Idea, Future, Scientific Principals, Introduction, Bibliography.

Chat tool
(to-dos, planning, coordination)

Selection Tool

Users: ganoe, PaigeKenley, JoelleGross

ganoe Login at 3:58 PM 6/18 Active

PaigeKenley (12/11/03 8:34 AM): actually, it's like, 3 whole entire sentences
 PaigeKenley (12/11/03 8:54 AM): sure
 PaigeKenley (12/11/03 8:54 AM): hold on a sec.. brb
 JoelleGross (12/11/03 8:54 AM): we can do some stuff on principles
 PaigeKenley (12/11/03 8:59 AM): ok
 JoelleGross (12/11/03 8:59 AM): we can get our history bubble back without doin it over again
 PaigeKenley (12/11/03 8:59 AM): well didnt find what i wanted.. looks like i'll just have to create from 3 sentences

Scientific Pri...
 These are the scientific concepts and principals of the maglev:
 -Aerodynamic drag
 -Magnetism
 -Center of mass
 -Moving charge
 -Magnetic field
 Magnetism is a phenomenon that occurs when a moving charge exerts a force on other moving charges. The magnetic force caused by these moving charge sets up a field which in turn exerts a force on other moving charges. This magnetic field is found to be perpendicular to the velocity of the current. The force of the field diminishes with distance from the charge.
 Some materials can be said to be natural magnets. These magnets don't appear to have any moving charge, so how can they set up magnetic fields? The answer is found at the atomic scale. Electrons circling an atom set up small magnetic fields. In most materials, these fields are aligned in a fairly random manner, so that all of these small fields cancel each other. In a magnet, however, these fields line up to create a net magnetic dipole, so that the object sets up a magnetic field in the surrounding space.
 Magnetic force is dependent on:
 -Length of wire
 -Current
 -Magnetic field strength
 Aerodynamic Drag is the force that fights against the forward progress of a Maglev train. If the shape of the train is properly streamlined, the air will flow around the train and cause little drag. For example if you were to have a little toy car and let it roll down a ramp it would go faster than if you were to put an index card in front of it. Or if you had a little box for the body of the car it would go slower than an oval car because of the wind resistance.

Collabs & status

Writtable by some + Readable by some +



- Summarize current project activity
 - Facilitate change inspection/verification

summary.rss 5 New, 25 Total

Name: Calendar; Object type: Calendar cganoe Aug 5, 03:25 PM
Changes to the calendar in the last 7 days:
"project video conference" is scheduled for 2:00 PM Thu, Aug 11, 2005; created at 3:35 PM Mon, Aug 8, 2005 by cganoe; [Read more...](#)

Name: ThreeRoles; Object type: Web Page cganoe Aug 5, 01:20 PM
18 sentences added; 0 sentences changed. First 3 differences:
""Engineer."
"PNG"
""ui_engineer.";
9 links added; 0 links changed. First difference:
Engineer.PNG;
0 embedded objects added/removed; 0 embedded objects changed;
Last modified by cganoe [Read more...](#)

Name: ui.png; Object type: Uploaded file cganoe Aug 5, 01:05 PM
Last modified by cganoe [Read more...](#)

Name: ui_team.png; Object type: Uploaded... cganoe Aug 5, 01:05 PM
Last modified by cganoe [Read more...](#)

Search Articles:
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- Spatially integrate work and awareness support

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Empirical studies

- Articulate testable hypotheses
 - Multiple levels of theory and method
- Experimental models
 - Synthesized breakdowns with confederates
 - Performance measures, protocol analysis, self-assessment scales, anaphoric/deictic reference
- Field studies
 - Critical incidents (collaborative breakdowns), discourse analysis, open coding of episodes



E.g., Common Ground

- *A state*
 - Maximize explicitly shared information
- *A social protocol*
 - Jointly construct sufficient shared understanding
 - Filter non-essential information, provide details on demand (i.e., what should not be shared?)
 - Identify and exchange information held by only some team members
 - Annotate information sources (i.e., negotiate meanings)



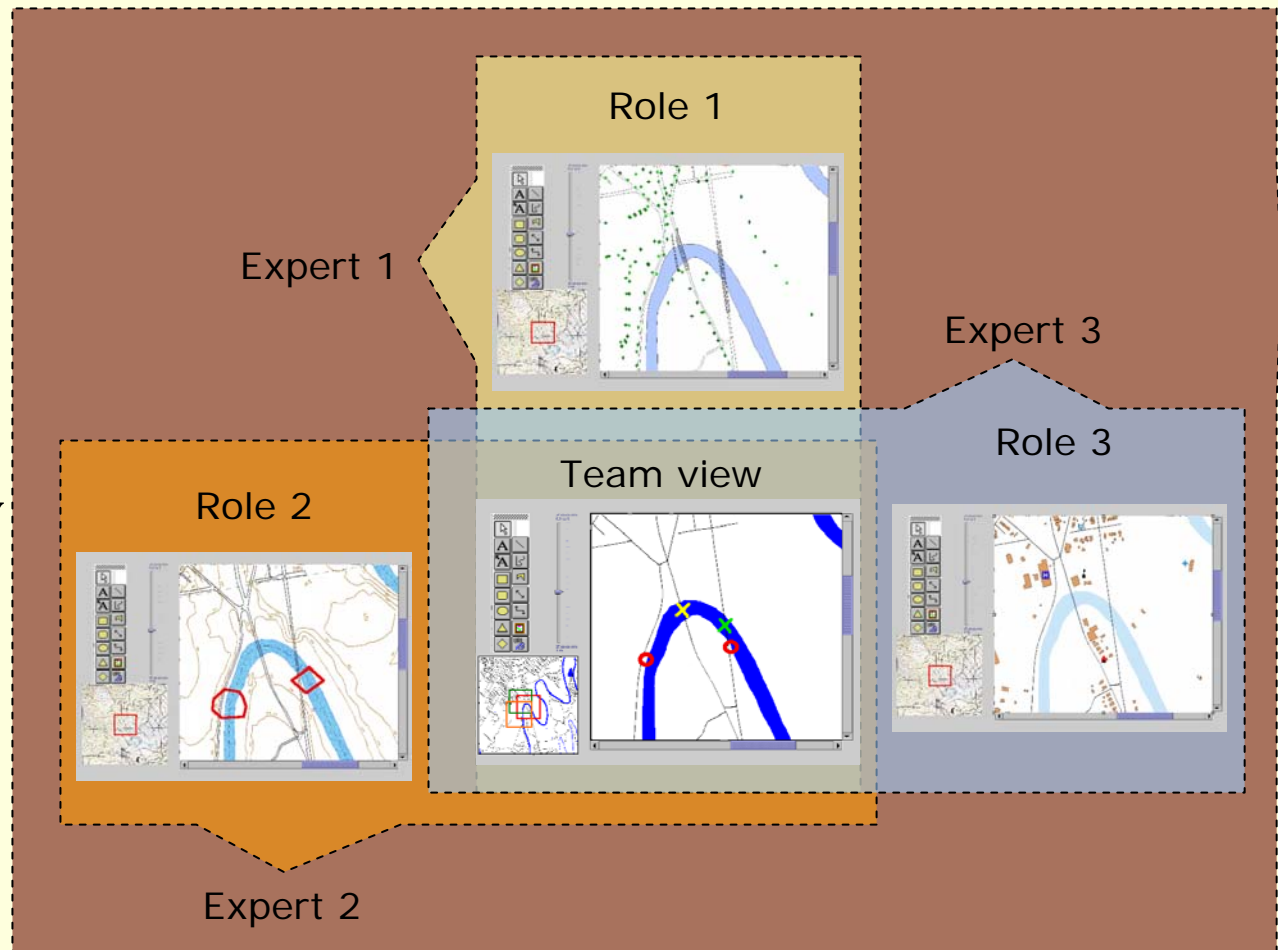
Emergency management scenario

Rescue families
stranded by
flood

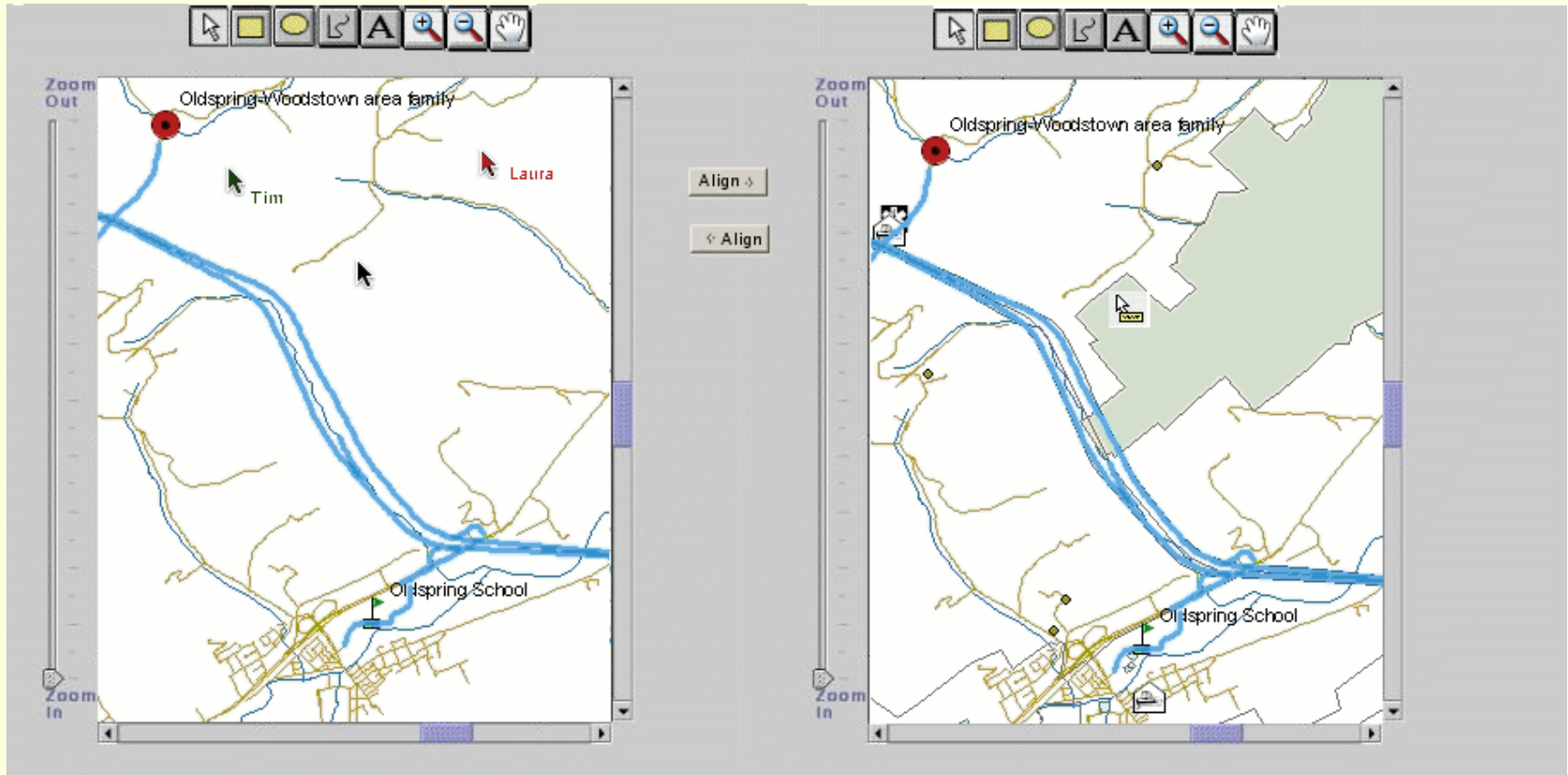
Role-specific
map-views

Complementary
knowledge

Team view is
constructed
jointly

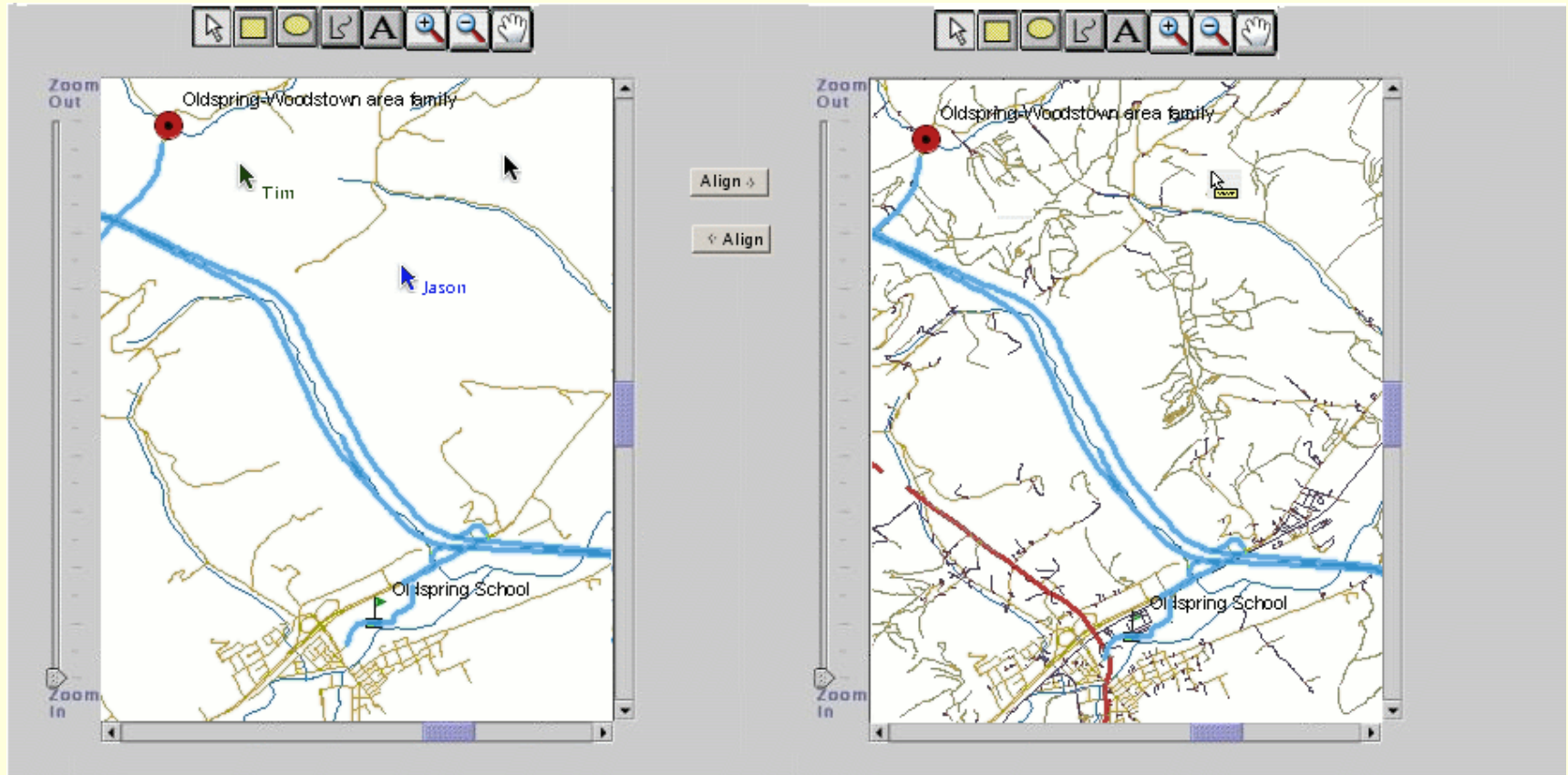


Mass Care View



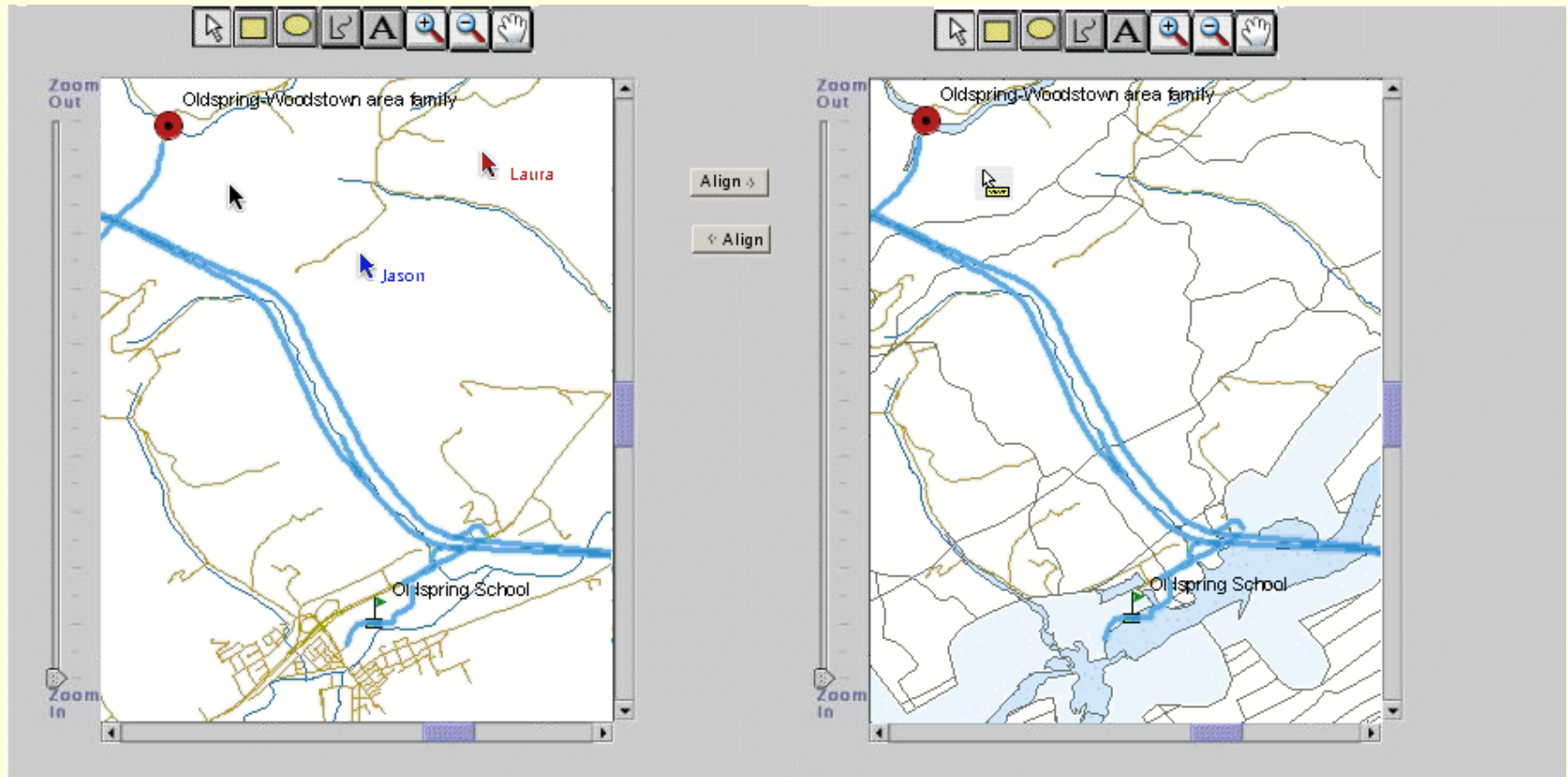
- Shelters, hospitals, schools, critical supplies, emergency vehicles

Public Works View



- Utilities and roadway infrastructure

Environmental View



- Waterways, flood plains, weather
- E.g., Old Spring School floods



Task design

- *Task for the team*: build the best plan
 - Plan components (and major source of info)
 1. Identify Shelter (Mass Care expert)
 2. Route and Transport (Public Works expert)
 3. Timing/schedule (Environmental expert)
- Hidden profile
 - Information allocation among the 3 “experts” is biased both toward their unique expertise area and toward a particular non-optimal solution



Hidden Profile

Plans/Roles	Public Works Route	Environment Time	Mass Care Shelter	Total Cons
A – unsh	a_1^s	$a_2^t a_3^r$	$a_4^s a_5^s a_6^r a_7^t$	7
B – unsh	$b_1^r b_2^r b_3^s b_4^t$	b_5^r	$b_6^s b_7^t$	7
C – unsh	$c_1^r c_2^t$	$c_3^t c_4^t c_5^r c_6^s$	c_7^t	7
D – sh	d_1^s	d_1^s	d_1^s	4*
D – unsh	d_2^r	d_3^t	d_4^s	
Total Knowledge	9	9	9	25

* Optimal Plan: plan with the least number of Cons

**Assumption: all Cons have equal strength & do not interact



Hidden Profile

Plans/Roles	Public Works Route	Environment Time	Mass Care Shelter	Total Cons
A – unsh	a_1^s	$a_2^t a_3^r$	$a_4^s a_5^s a_6^r a_7^t$	7
B – unsh	$b_1^r b_2^r b_3^s b_4^t$	b_5^r	$b_6^s b_7^t$	7
C – unsh	$c_1^r c_2^t$	$c_3^t c_4^t c_5^r c_6^s$	c_7^t	7
D – sh	d_1^s	d_1^s	d_1^s	4*
D – unsh	d_2^r	d_3^t	d_4^s	
Total Knowledge	9 s = 3 r = 4 t = 2	9 s = 2 r = 3 t = 4	9 s = 5 r = 1 t = 3	25

* Optimal Plan: plan with the least number of Cons

**Assumption: all Cons have equal strength & do not interact



Examples of Cons

1. Public Works expert

e.g., This route is an older street and has an obsolete *drainage system*

2. Environmental expert

e.g., This route goes through a *floodplain*

3. Mass Care expert

e.g., There are no appropriate *vehicles* for this route



E.g., Environmental Expert





E.g., Environmental Expert





E.g., Environmental Expert



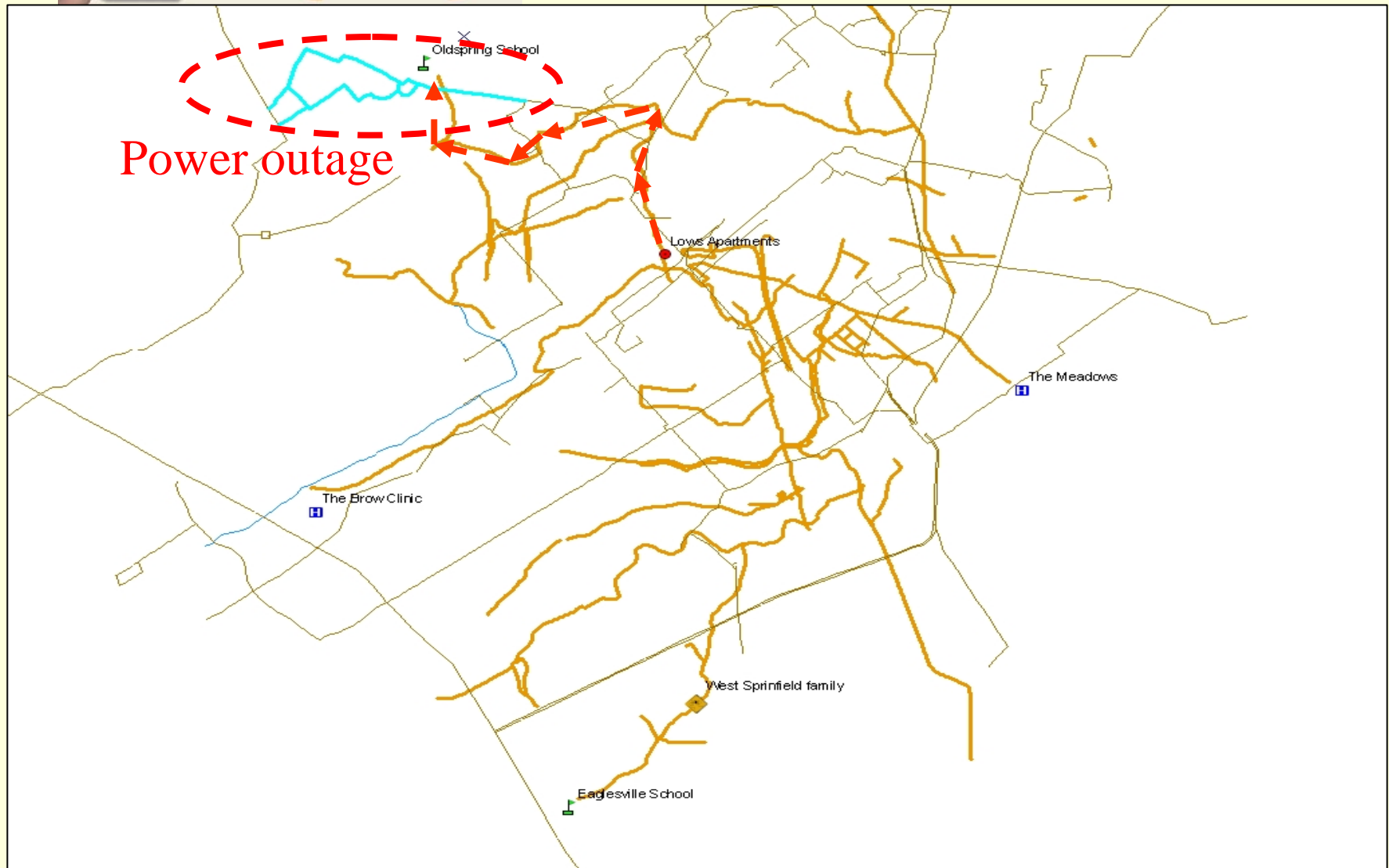


E.g., Public Works Expert





E.g., Public Works Expert





Team View





Team View





Measuring common ground

- Psychometric scales
 - Communication, awareness, efficacies
- Linguistic-content analysis (Clark et al)
 - Deictic references, reference breakdowns
- Recall/cued recall for who did what, and why (Monk et al)
 - Convergence
- Performance
 - Time, output quality, satisfaction



Goals

- Validate lab model wrt hidden profile results for this more complex task
 - Expert role manipulation - belief that self and others have valuable information and equi-status favor sharing
 - Critical perspective (ranking alternatives, differences of opinion, discussion at all) favors sharing
- Explore more complex/interesting tasks and instructional manipulations
- Explore alternative user interface designs



The intricate dance

- Awareness in collaboration beyond radar views
 - Presence, current action, locus of attention
- Real shared activity seems more complex
 - longer term, ill-defined, social, developmental
 - Common ground, community of practice, social capitalization, human development
- This complexity also provides *resources*
 - Complementary knowledge, community formation, trust, human development



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Comments, Questions, Suggestions? Thanks!



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